singing, drill, and cookery or handicraft. It is a matter of common experience that whatever increases the vigour or quickens the intelligence of children enables them to acquire book-learning in a much shorter space of time. In whatever points educationists may differ, there will be a general agreement that the bodily senses of our young working-class population ought to be developed as well as their mental faculties, and that it is highly important for them at least to know something of the world in which they live and of the materials and natural forces with which they work. J. H. GLADSTONE

THE DISTRIBUTION OF THE METEOROLOGICAL ELEMENTS IN CYCLONES AND ANTICYCLONES

Sur la Distribution des Éléments Météorologiques autour des Minima et des Maxima Barométriques. Par H. Hildebrand Hildebrandsson. Présenté à la Société Royale des Sciences d'Upsal le 10 Mars, 1883. (Upsal, 1883.)

WITH the publication of the first synoptic weather-maps in Europe and America about the middle of the present century, the scientific study of the great movements of the atmosphere and other phenomena of weather may be considered as having commenced. This method of inquiry soon taught us that in different parts of one and the same barometric depression or cyclone, very different climatic conditions prevailed. In the front part of the depression the weather is warm, moist, and clouded, whilst in the rear it is cold, dry, and clear. Further inquiry showed equally distinct types of weather characterising different parts of high-pressure areas or anticyclones. So close indeed are these relations that the study of weather resolves itself very much into an examination of the phenomena attending cyclones and anticyclones. If we could certainly prognose the distribution of atmospheric pressure over North-Western Europe on, say, Saturday next, we could for the same time forecast pretty correctly the weather over this part of the earth. Similarly, if we could forecast that the easterly tracks of the cyclones of the coming winter were to be south of the Channel, we could forecast a severe winter for the British Islands; and on the other hand if the path taken by these cyclones would be to the north of these islands, an unusually mild winter would certainly follow. Hence the supreme importance of any accession to our knowledge respecting cyclones and anticyclones. This is what Prof. Hildebrandsson's laborious and able paper does in various directions.

The direction and velocity of the wind as noted at Upsala at the surface of the earth, in the region of the lower clouds, and in the higher region of the cirrus, the temperature of the air, the amount of cloud, the frequency of rain, the transparency of the air, and the occurrence of fog are examined with reference to forty-three different sections or areas into which the author has partitioned cyclonic and anticyclonic systems according to the direction of the barometric gradient and the height of the barometer, three of these forty-three sections being the central areas of the cyclone and the anticyclone, and the space separating two cyclones which are not far apart.

As regards the direction of the wind it is shown that the angle made by the wind with the barometric gradient is greater in summer than in winter; greater at stations near the sea than at inland places; greater in cyclonic than in anticyclonic regions; and that the angle is the maximum, or the wind approximates most nearly to a circular course, when the gradient is directed towards the east, and the minimum when directed towards the west. The angle obtained for Upsala, which is nearly 50°, is greater than that obtained by Loomis for the United States, but less than what Mohn has found for Norway and Clement Ley for the British Islands. The observations made on three small islands were also examined, viz. Utklippan, a little to the south of Karlskrona, Wäderöbod, north-east of Jutland and a few miles off the Swedish coast, and Sandön, a low sand-bank about thirty-four miles north of Gothland, at which stations the angles are respectively 64°, 65°, and 74°. Here the influence of the sea on the angle made by the wind with the gradient is very striking, being about a half more at the strictly insular position of Sandön than at Upsala.

The angle is at the maximum in the three islands when the gradient is directed towards the east, and the minimum when directed towards the west, as at Upsala, and as Clement Ley has shown for England, Hoffmeyer for Denmark, and Spindler for Russia. One remarkable result is, however, shown with reference to each of the three islands, viz. the angle shows a well-pronounced secondary maximum when the gradient is directed towards the north-west. It is premature to attempt an explanation of the different degrees of the incurving of the wind upon the centre in the different parts of a cyclone, until similar results have been worked out for a large number of well-selected individual stations, and until a more definite knowledge is arrived at regarding the relative prevalence of ascending and descending aërial currents in the different sections of the cyclone and anticyclone.

The velocity of the wind is the minimum near the centres of cyclones and anticyclones, and in the middle space between the cyclones. From the central region of the anticyclone, the velocity of the wind increases as the barometer falls, and the maximum velocity is reached on approaching the calm central region of the cyclone. With respect to the gradients, the greatest velocity appears to occur when the gradient is directed towards the north and the least when the gradient is towards the west or the south-west.

In the region of the lower clouds, the wind takes a direction to the right of that of the wind at the surface of the earth. In other words, at this height the winds tend to follow the course of the isobars drawn for the sea-level pressure, with however two noteworthy exceptions. When the gradient is directed towards the west, the angle exceeds 90°; but when directed towards the south or south-east, it is markedly less than 90°.

In the higher region of the cirrus clouds, the winds blow centrifugally from the region of the cyclone towards that of the anticyclone. The velocity is least in the vicinity of the central region of the cyclone, but it steadily increases as it approaches and flows over the region of the anticyclone. The centrifugal movement is greater in

© 1884 Nature Publishing Group

the front than in the rear of a cyclone, where indeed the motion of the cirrus cloud approaches the direction of the lower clouds and of the wind at the surface of the earth. The direction of the cirrus immediately behind and over the centre of depression is in Sweden generally from north or west, but, from the exceptions which occur, it is evident that more observations and discussions of the results are required.

Fog is of most frequent occurrence when the gradient is directed towards the north and least frequent when directed towards the south. In the Kattegat, fog attains its maximum frequency in the region situated between the lowest and the highest pressures. At Upsala the clearness of the air is nearly independent of barometric pressure, there being, however, a greater tendency to mistiness in the air when the gradient is directed towards the west than other directions. Cloud and rain are most frequent with gradients to the south or west, and least with gradients to the north-east. In summer, they regularly diminish as pressure increases; but in winter, less regularly, inasmuch as the strato-cumulus, which are the most common clouds in this season, are most numerous in times of high pressure and occasionally bring with them slight showers of snow.

In winter, temperature is above the mean both in cyclones and anticyclones when the gradient is directed towards the west, and below it when directed towards the east. In the same season, temperature rises on all sides towards the centre of the cyclone; in other words, the thermometer rises as the barometer falls, and *vice versâ*. In winter also temperature is ordinarily above the mean in cyclones, but under it in anticyclones and in the region between two cyclones; in summer the reverse holds good—these results being due to the different effects of solar and terrestrial radiation in these seasons.

With reference to the distribution of temperature with height, Hildebrandsson has examined the observations made at the Puy-de-Dôme and at Clermont Ferrand, near the base of the mountain in connection with the cyclones and anticyclones in that part of Europe during 1877-82. The difference between the temperatures of the two places in winter attains the maximum in the vicinity of the centre of a cyclone, and the difference diminishes according as the barometer rises, and the minimum is reached near the centre of the anticyclone, where temperature on the mean is higher at the higher station, the difference in height being 3516 feet. In such investigations, this high-level station, as well as the high-level stations in the south of France, in Switzerland, and Austria, have the disadvantage of being almost always on the north-west slope of anticyclonic areas, the centres of which are situated in a south-westerly direction. It is on rare occasions that well-marked cyclones cross these stations, and still rarer that cyclones pass to the south-west of them. Prof. Hildebrandsson states his opinion that, for the prosecution of these all-important researches, Ben Nevis, with its low- and high-level stations, occupies what is, perhaps, the most favourable position in the world, seeing that it is situated in the track of the greater part of the Atlantic storms which sweep over North-Western Europe, and that the publication of the observations *in extenso* would be an important gain to science.

"FLATLAND"

Flatland: a Romance of Many Dimensions. With Illustrations by the Author, A Square. (London: Seeley and Co., 1884.)

WE live in an age of adventure. Men are ready to join in expeditions to the North Pole or to the interior of the African continent, yet we will venture to say that the work before us describes a vast plain as yet untrodden by any Fellow of the Royal Geographical Society, and teeming with a population of which no example has figured in any of our shows. A few years ago a distinguished mathematician published some speculations on the existence of a book-worm "cabin'd, cribb'd, confin'd" within the narrow limits of an ordinary sheet of paper, and another writer bewailed "the dreary infinities of homoloidal space." A third remarks, "there is no logical impossibility in conceiving the existence of intelligent beings, living on and moving along the surface of any solid body, who are able to perceive nothing but what exists on this surface and insensible to all beyond it." How delighted Prof. Helmholtz will be to find, if this Flatland writer is worthy of credence, his conjecture thus verified. "Flatland" is not the real name of this unknown land (that secret is not divulged), but it is so called here to make its character clear to us Space-denizens. It is a noteworthy fact that one at least of the Flatlanders expresses himself in remarkably correct English, and singularly after the manner of an ordinary Space-human being; and further, though—we regret to have to record it—as a martyr in the cause of the truth of a third dimension, he has spent seven long years in the State jail, yet these memoirs have in some mysterious manner found their way into our hands. There is hope then that some one of our readers may yet expatiate in the broad plain, though the penalty will be, we fear, that he must first become as flat as a pancake and then see to it that his configuration (as a triangle, square, or other figure) is regular. This latter is a *sine quâ non* in Flatland, because, whatever you are, your configuration must be regular, or woe betide you, and you will shuffle off your mortal coil incontinently.

We will not stop to inquire how this and that have come about, but will endeavour to lay before our readers some of the features of this (to us) new world, though we are informed that it has just entered upon its third millennium.[1]

In Flatland there is no sun nor any light to make shadows, but there is fog. This, which we on this earth consider to be an unmitigated nuisance, is recognised in that other world "as a blessing scarcely inferior to air itself, and as the Nurse of Arts and Parent of Sciences." If there were no fog, all lines would be equally distinct, whereas under present circumstances, "by careful and constant experimental observation of comparative dimness and clearness, we are enabled to infer with great exactness the configuration of the object observed." It is a necessity of Flatland life to know the north (for instance, it is a point of good breeding to give a lady the north side of the way); this is determined in the absence

[1] From the secret Archives it appears that at the commencement of each millennium a Sphere descended into the midst of the Council of Circles proclaiming the great truth for the attempted teaching of which our author is in bonds.

© 1884 Nature Publishing Group